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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/429,869	10/29/1999	PAUL P. CASTRUCCI	910LMC	6432

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NEWTON, MA 02466

EXAMINER

MAI, ANH D

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 06/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/429,869

Applicant(s)

CASTRUCCI, PAUL P.

Examiner

Anh D. Mai

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 May 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-19,29-32,34 and 37-64 is/are pending in the application.
- 4a) Of the above claim(s) 34 and 64 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-19,29-32 and 37-63 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 October 1999 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2. 6) ☐ Other: _____

DETAILED ACTION

Specification

1. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.
2. The numbering of claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution. When claims are canceled, the remaining claims must not be renumbered. When new claims are presented, they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

It appears that claim 7 does not exist as filed. To simplify the process, claim 7 is cancelled so that the re-numbering of the claims (64 claims) is avoided.

Status of the Claims

3. Amendment filed January 22, 2001 has been entered as Paper No. 6. Claims 1, 20-28, 33, 35 and 36 have been canceled. Claims 2-6, 8-19, 29-32, 34 have been amended. Claims 37-64 have been added. Claims 2-6, 8-19, 29-32, 34 and 37-64 are pending. Claims 34 and 64 have been withdrawn.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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4. Claims 6, 12, 15, 17 and 43 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 6, 12, 15 and 17 recite the limitation "said exposing step" in line 2 and 1, respectively. There is insufficient antecedent basis for this limitation in the claim.

Claim 37 does not includes "exposing step".

Claim 43 recites the limitation "further comprising the step of measuring particles on the substrate be fore said step (b) of applying said sacrificial film" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim.

Note that there is no "particles" before step (b).

How can a measurement be made when the matter does not exist ?

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

5. Claims 29, 31 and 32 are rejected under 35 U.S.C. 102(b) as being anticipated by H.K. Park et al., *A Practical Excimer Laser-Based Cleaning Tool for Removal of Surface Contaminants*.

With respect to claim 29, Park teaches a method for removing particles from a surface of a substrate as claimed including:

- a) applying a film of sacrificial material to the surface;
- b) locating the particles on the surface and recording coordinates of each particles; and
- c) shining light at the coordinates to selectively remove particles whose coordinates were recorded. (See pp. 631-644).

With respect to claim 31, since the method of Park includes selective cleaning thus, comparing the coordinates recorded are inherent of the process.

With respect to claim 32, the method of Park includes cleaning of only the contaminated spot thus meet the claim.

6. Claims 37-43, 48-51, 60-63, 2-6, 12 and 14-19 are rejected under 35 U.S.C. 102(e) as being anticipated by Elliott et al., (U.S. Patent No. 5,669,979) of record.

With respect to claim 37, Elliott teaches a method of processing a substrate as claimed including:

- a) providing a substrate (12) comprising patterns for electronic circuitry;

b) providing a liquid film (10) on the substrate (12) and drying solvent in the liquid to provide a dried unpatterned sacrificial film from the substrate;

c) transferring energy (14) to physically remove the dried unpatterned sacrificial film (10) from the substrate (12), wherein removing film (10) facilitates cleaning particles from the substrate. (See Fig. 1).

Regarding drying the solvent in the liquid film (10), since the organic layer (10) of Elliott comprises materials such as polymer, photoresist, polyamide e.g., it is well known in the art that these materials are subjected to drying step to remove solvent following the deposition on a substrate.

Since method of Elliott includes removing film (10), thus meet the limitation "removing said film facilitates cleaning particles from the substrate".

With respect to claim 2, the providing a liquid film (10) of Elliott comprises applying film (10) to an effective thickness for removal of the particles.

With respect to claim 3, the sacrificial film (10) of Elliott appears to comprises the thickness as claimed.

With respect to claims 4 and 5, the formation of film (10) of Elliott is well known in the art including spraying, spinning a solution onto the substrate (12).

With respect to claim 6, as best understood by the examiner, the formation of film (10) of Elliott inherently includes drying, see claim 37 above.

With respect to claim 12, the film (10) of Elliott is exposed to light from an excimer laser having an effective wavelength for removing the sacrificial film (10).

With respect to claim 14, the light from the excimer laser of Elliott irradiates substrate (12) at less than about 100 mjoules/cm².

With respect to claim 15, the method of Elliott further includes providing a flow of vapor (18) across substrate (12) while performing the shinning step.

With respect to claim 16, the flow of Elliott is laminar flow.

With respect to claim 17, the method of Elliott further includes providing a flow of an inert gas (18) across substrate (12) while performing the shinning step.

With respect to claim 18, the inert gas of Elliott is selected from the list consisting of nitrogen and argon.

With respect to claim 19, the flow of Elliott is laminar flow.

With respect to claim 38, the dried material (10) of Elliott comprises an organic material.

With respect to claim 39, the dried material (10) of Elliott comprises resist.

With respect to claim 40, the transferring energy (14) of Elliott comprises irradiating film (10) with light.

With respect to claim 41, irradiating film (10) with light (14) of Elliott includes shinning a laser (14) on film (10).

With respect to claim 42, the laser of Elliott includes pulsed UV laser.

With respect to claim 43, as best understood by the examiner, method of Elliott further includes measuring particles on the substrate (12).

With respect to claim 48, the composition measurement of Elliott includes Auger analysis, thus, comprises x-ray dispersive spectroscopy of particles on the substrate.

With respect to claim 49, the parameter of Elliott is selected based on data from the measuring particles on the substrate (12).

With respect to claim 50, selecting parameter of Elliott includes selecting parameter based on type of particles or composition of particles.

With respect to claim 51, the parameter of Elliott selects a wavelength that is higher than the required to break bonds.

With respect to claim 60, substrate (12) provides in step (a) of Elliott is provided after a step in a process flow of fabricating the electronic circuitry on the substrate (12) but before other fabrication steps are complete.

With respect to claim 61, the transferring energy step (c) of Elliott comprises an area cleaning.

With respect to claim 62, the area cleaning of Elliott is proved by providing laser beam (14) and scanning the laser beam (14) or by scanning the substrate (12) with respect to the laser beam (14)

With respect to claim 63, the substrate (12) of Elliott comprises a semiconductor wafer or a mask.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 30 and are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. as applied to claim 29 above, and further in view of Engelsberg et al. (U.S. Patent No. 5,800,625) of record.

Park is shown to teach all the features of the claim with the exception of explicitly providing an inert gas flow across the surface while shining light at the surface.

However, Engelsberg teaches a method of removing particles including: providing a flow of an inert gas across the surface while performing shining light on the surface.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to provide a flow of an inert gas across the surface of a substrate of Park as taught by Engelsberg to prevent the contaminant from redeposit on the treated surface.

8. Claims 8-11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Elliott '979 as applied to claims 37 and 12 above, and further in view of Ouderkirk et al. (U.S. Patent No. 5,061,604).

With respect to claims 8, 10 and 11, Elliott teaches applying film (10) of sacrificial material on substrate (12).

Thus, Elliott is shown to teach all the features of the claim with the exception of explicitly disclosing the addition of nitrocellulose (pyroxylin, collodion).

However, Ouderkirk teaches a self developing photoresist systems which photo-decompose, volatilize and vaporize when exposed to U.V. light. (See col. 1, ll.36-48).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to applying film of sacrificial material on substrate of Elliott including a quantity of nitrocellulose as taught by Ouderkirk to make the sacrificial more volatile under the U.V. light thus, increase the efficiency of the laser cleaning.

With respect to claim 9, the solution of soluble nitrocellulose in a mixture of alcohol and ether is well known in the art.

With respect to claim 13, the sacrificial film (10) of Elliott, in view of Ouderkirk, is collodion and the effective wavelength (14) is within the claimed range.

9. Claims 52-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Elliott '979 as applied to claim 43 above, and further in view of Park et al.

With respect to claim 52, Elliott teaches measuring particles on the substrate.

Thus, Elliott is shown to teach all the features of the claim with the exception of providing a map of particles on the substrate in the measuring step.

However, Park teaches a laser cleaning method including selective cleaning, e.g. cleaning of only a contaminated spot, hence location of the contaminants are identified or mapped.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to identify or mapping the substrate (12) of Elliott prior to perform laser cleaning as taught by Park because mapping makes the cleaning process simple and quick, avoiding redundant cleaning of clean areas, thus minimizes overall fabrication time.

With respect to claim 53, the transferring energy of Park includes aiming a beam at location found in the measuring.

With respect to claim 54, the beam of Park includes a laser beam and wherein the method further includes selecting a recipe of the laser cleaning step based on the identified particles from the measurement.

With respect to claim 55, the laser cleaning method of Park further includes the step of setting the laser with generic recipe for cleaning particles found in the measurement.

With respect to claim 56, the recipe of Elliot in view of Park is selected for each specific type of particles characterized in the measurement step and wherein the selective laser cleaning is directed to location of the wafer where specific particles are actually located as determined in the measurement.

10. Claims 44, 45 and 57-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Elliott '979 as applied to claim 43 above, and further in view of Engelsberg '625.

With respect to claim 44, Elliott is shown to teach all the features of the claim with the exception of explicitly disclosing a computer software defect classification.

However, Engelsberg teaches a laser cleaning method including a measurement step using Particle Measurement Systems (PMS) silicon wafer particle counter Model 3600 XP.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to measure the particles of Elliott using the particle counter of Engelsberg to determine the type and size of the particles to be remove.

With respect to claim 45, the system of Engelsberg is auto defect classification.

With respect to claim 46, the measurement of Engelsberg inherently provides type, composition, density or position of particles on the substrate.

With respect to claim 57, Elliott is shown to teach all the features of the claim with the exception of explicitly storing the measurement in a data record for the substrate.

However, Engelsberg teaches the number of contaminant particles on the substrate in a number of size ranges can be compared before and after treatment. (See col. 13, lines 1-18).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to record the measurement of Elliott as taught by Engelsberg because the data recorded can be used to determine the effect of the laser cleaning process.

With respect to claim 58, the method of Engelsberg also includes a second measurement of the contaminant particles on the substrate after the cleaning step.

With respect to claim 59, it is obvious to perform a second cleaning step in view of Engelsberg because if the contaminant particles are detected by the second measurement. After all, the method is removing of contaminant particles on a substrate.

11. Claim 47 is rejected under 35 U.S.C. 103(a) as being unpatentable over Elliott '979 and Engelsberg '625 as applied to claim 46 above, and further in view of Engelsberg (U.S. Patent No. 5,099,557) of record.

Elliott '979 and Engelsberg '625 are shown to teach all the features of the claim with the exception of including an exhaust gas analyzer.

However, Engelsberg '557 teaches using an exhaust analyzer (27) to analyze the content of exhaust gas. (see Fig. 1).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to measure the particle of Elliott using the exhaust gas analyzer as taught by Engelsberg to facilitate selective energy and wavelength adjustment for the laser.

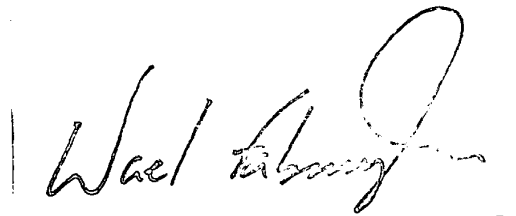
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
June 11, 2003


SUPERVISORY PRIMARY EXAMINER
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